

REMARKS

Reconsideration and allowance of the claims are requested in view of the above amendments and the following remarks. Claims 1, 23, 45, 46 and 54 have been amended. Support for the amendments may be found in the specification and claims as originally filed. For example, support for the claim amendments may be found in the specification at least at page 11, line 12 – page 12, line 3; page 16, line 21 – page 17, line 8; and Figure 4. No new matter has been added.

Upon entry of this amendment, claims 1-61 will be pending in the present application, with claims 1, 23, 45, 46 and 54 being independent.

1. Rejections Under 35 U.S.C. §102

The Office Action rejects claims 1-18, 22-40 and 44-61 under 35 U.S.C. §102(b) as being anticipated by Bruno (“Automatic management of statistics on query expressions in relational databases”). Applicants respectfully traverse this rejection for at least the following reasons.

Bruno discloses the concept of generating statistics using the attributes of the results of query expressions, also known as statistics on intermediate tables (SITs), to generate estimated cardinalities of similar query plans (see pages 1-2 and 8). Bruno discloses a modified cardinality estimation module that transforms an input query plan into another one that exploits SITs by performing the following steps: (1) analyze the input query plan, (2) identify and apply relevant SITs, and (3) estimate and return the cardinality of the transformed query plan (see sections 3.1, 3.2 and Figure 3.1(a)-(f)). Figure 3.1 shows an example of a transformation algorithm in the modified cardinality estimation module.

However, Bruno fails to disclose or suggest utilizing conditional selectivity as a framework to identify and exploit SITs which are useful for cardinality estimates. In embodiments of the present application, conditional selectivity is used as a framework for

manipulating query plans to leverage statistical information on intermediate query results in order to provide more efficient query plans (see specification, page 1, lines 18-20). The concept of conditional selectivity allows expression of a given selectivity value in many different but equivalent ways (see page 9, lines 19-20). For example, amended independent claim 1 recites:

1. A method for approximating a number of tuples returned by a database query that comprises a set of predicates that each reference a set of database tables, the method comprising the steps of:
 - a) expressing the query as a query selectivity;
 - b) determining if the query is separable and if so separating the query selectivity to form a product of query selectivity factors;
 - c) if the query is not separable, atomically decomposing the query selectivity to form a product that comprises a conditional selectivity expression; (emphasis added)

Therefore, claim 1 includes a form of conditional selectivity, which is also illustrated in Figure 4. For instance, if the query is separable, the query selectivity is separated to form a product of query selectivity factors (i.e., step b) of claim 1, and item 420 of Figure 4). However, if the query is not separable, the query selectivity is atomically decomposed to form a product that comprises a conditional selectivity expression (i.e., step c) of claim 1, and items 430 and 440 of Figure 4). Bruno fails to disclose or suggest steps b) and c) of claim 1, or any concept of conditional selectivity whatsoever, at the sections cited by the Office Action or elsewhere. Additionally, since Bruno fails to disclose or suggest steps b) and c) of claim 1, Bruno also fails to disclose or suggest step d) of claim 1, which recites “recursively performing steps b) – c) to determine a selectivity value for each query selectivity factor”. Independent claims 23, 45, 46 and 54 include, in some form, similar elements as those discussed above with respect to claim 1.

Furthermore, the Office Action on page 15 states that “decomposition of the query” is understood to be nothing but separating elements of a query so that each can be processed. However, applicants have amended independent claims 1, 23, 45, 46 and 54 to provide further

clarification of these claims. These claims include the element of atomically decomposing the query selectivity to form a product that comprises a conditional selectivity expression if the query is not separable. As discussed on page 11, lines 16-18, of the specification of the present application:

Atomic decomposition is based on the notion of conditional probability and unfolds a selectivity value as the product of two related selectivity values:

$$\text{Sel}_R(P,Q) = \text{Sel}_R(P|Q) \cdot \text{Sel}_R(Q)$$

Bruno does not disclose or suggest, in the sections cited by the Office Action or elsewhere, atomically decomposing the query selectivity, or the above-noted equation for an atomically decomposed selectivity value.

Moreover, the Office Action asserts that Bruno specifically suggest “decomposition of the query” as detailed in page 10, Figure 3.1, and also in the query execution plan in Figure 3.2. However, Figures 3.1 and 3.2 of Bruno do not demonstrate an algorithm performing any type of decomposition. In contrast, Figure 3.1 of Bruno demonstrates an algorithm that makes use of SITs to transform an initial query plan to produce a resulting query plan. Similarly, Figure 3.2 illustrates an original optimized query execution plan and a modified optimized query execution plan. The query execution plans shown in the figures illustrate steps of the plan, not decomposition of the queries. No decomposition of a query is disclosed in Figures 3.1 and 3.2, let alone atomically decomposing a query selectivity, as included in independent claims 1, 23, 45, 46 and 54.

Therefore, since Bruno fails to disclose, or even suggest, each and every element of claims 1, 23, 45, 46 and 54, these claims are allowable.

Claims 2-18 and 22 depend from claim 1. Claims 24-40 and 44 depend from claim 23. Claims 47-53 depend from claim 46. Claims 55-61 depend from claim 54. As discussed above, claims 1, 23, 46 and 54 are allowable. For at least this reason, and the features recited therein,

claims 2-18, 22, 24-40, 44, 47-53 and 55-61 are also allowable.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-18, 22-40 and 44-61 under 35 U.S.C. §102(b) are respectfully requested.

2. Rejections Under 35 U.S.C. §103

The Office Action rejects claims 19-21 and 41-43 under 35 U.S.C. §103(a) as being unpatentable over Bruno in view of Acharya et al. (U.S. Patent 6,477,534). Applicants respectfully traverse this rejection for at least the following reasons.

As discussed above, Bruno fails to disclose, or even suggest, each and every element of claims 1, 23, 45, 46 and 54. Acharya et al. fails to cure this defect in Bruno.

Acharya et al. discloses a technique that generates approximate answers in a data warehouse environment in response to complex aggregate queries based on statistical summaries of the full data of a database (see col. 5, lines 39-42). However, Acharya et al. fails to disclose or suggest at least the elements of:

- b) determining if the query is separable and if so separating the query selectivity to form a product of query selectivity factors;
- c) if the query is not separable, atomically decomposing the query selectivity to form a product that comprises a conditional selectivity expression;
- d) recursively performing steps b) – c) to determine a selectivity value for each query selectivity factor;

as included, in some form, in independent claims 1 and 23. Therefore, since Bruno and Acharya et al., alone or in combination, fail to disclose or suggest all of the elements of claims 1 and 23, these claims are allowable.

Claims 19-21 depend from independent claim 1. Claims 41-43 depend from independent claim 23. As discussed above, claims 1 and 23 are allowable. For at least this reason, and the additional features recited therein, claims 19-21 and 41-43 are also allowable.

Type of Response: Amendment
Application Number: 10/608,083
Attorney Docket Number: 302692.01
Filing Date: June 27, 2003

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For at least the reasons above, reconsideration and withdrawal of the rejection of claims 19-21 and 41-43 under 35 U.S.C. §103(a) are respectfully requested.

3. Conclusion

Accordingly, in view of the above amendment and remarks it is submitted that the claims are patentably distinct over the prior art and that all the rejections to the claims have been overcome. Reconsideration and reexamination of the present application is requested. Based on the foregoing, applicants respectfully request that the pending claims be allowed, and that a timely Notice of Allowance be issued in this case. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the applicants' attorney at the telephone number listed below.


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If this response is not considered timely filed and if a request for an extension of time is otherwise absent, applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check please charge any deficiency to Deposit Account No. 50-0463.

Respectfully submitted,
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Date: December 11, 2006

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December 11, 2006
Date


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Kate Marochkina
Type or Print Name

Type of Response: Amendment
Application Number: 10/608,083
Attorney Docket Number: 302692.01
Filing Date: June 27, 2003